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| 10/674,853   | 09/29/2003  | Katayun Barnak       | YOR920030338US1     | 6319             |
| 29683 7590 09/21/2009<br>HARRINGTON & SMITH, PC<br>4 RESEARCH DRIVE, Suite 202<br>SHELTON, CT 06484-6212 |             |                      |                     |                  |
| EXAMINER   |             |                      |                     |                  |
| GRAYBILL, DAVID E  |             |                      |                     |                  |
| ART UNIT   |             | PAPER NUMBER         |                     |                  |
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

# Office Action Summary

## Application No.

10/674,853

## Applicant(s)

BARMAK ET AL.

## Examiner

David E. Graybill

## Art Unit

2894

**Period for Reply** -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 04 June 2009.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 19, 61 and 66-93 is/are pending in the application.
- 4a) Of the above claim(s) 67-81, 83-87 and 89-93 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 19, 61, 66, 82 and 88 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB08)
- 4) ☐ Interview Summary (PTO-413)
- 5) ☐ Paper No(s)/Mail Date \_\_\_\_\_
- 6) ☐ Other: \_\_\_\_\_

Claims 67, 80, 81, 83-87 and 89-93 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected species, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 6-04-09.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 19, 61, 66, 82 and 88 are rejected under 35 U.S.C. 103(a) as being unpatentable over Li (20040192021).

At paragraphs 12 and 62-64, Li discloses the following:

Re claim 19: A "diffusion barrier" comprising a plurality of stacked inherently amorphous sub-layers, each sub-layer having a thickness of nanometers (nm), wherein the plurality of stacked amorphous sub-layers are arranged collectively to inhibit diffusion of a chemical species through the diffusion barrier, and where the plurality of stacked amorphous sub-layers are three or more stacked amorphous sub-layers, wherein the stacked amorphous sub-layers are of alternating composition, where an amorphous sub-layer of tantalum (Ta) alternates with an amorphous sub-layer of copper (Cu), wherein the amorphous sub-layers in the diffusion barrier are mutually adhesive.

Re claim 61: A diffusion barrier as in claim 19, where the plurality of sub-layers in the diffusion barrier are between three and ten in number.

Re claim 66: A diffusion barrier as in claim 19, wherein the diffusion barrier is a circuit interconnect.

Re claim 82: A diffusion barrier as in claim 19, wherein each sub-layer has a thickness of nanometers (nm).

Re claim 88: A diffusion barrier as in claim 19, wherein the diffusion barrier is electrically conductive.

The following is further clarified:

Re claim 19: each sub-layer having a thickness of nanometers (nm).

Re claim 82: each sub-layer has a thickness of nanometers (nm).

In particular, each sub-layer of Li has a thickness of nanometers because each sub-layer can be measured in units of nanometers.

MPEP 2112 [R-3] Requirements of Rejection Based on Inherency; Burden of Proof  
V. ONCE A REFERENCE TEACHING PRODUCT APPEARING TO BE SUBSTANTIALLY IDENTICAL IS MADE THE BASIS OF A REJECTION, AND THE EXAMINER PRESENTS EVIDENCE OR REASONING TENDING TO SHOW INHERENCY, THE BURDEN SHIFTS TO THE APPLICANT TO SHOW AN UNOBVIOUS DIFFERENCE  
"[T]he PTO can require an applicant to prove that the prior art products do not necessarily or inherently possess the characteristics of his [or her] claimed product. Whether the rejection is based on inherency' under 35 U.S.C. 102, on prima facie obviousness' under 35 U.S.C. 103, jointly or alternatively, the burden of proof is the same...[footnote omitted]." The burden of proof is similar to that required with respect to product-by-process claims. In re Fitzgerald, 619 F.2d 67, 70, 205 USPQ 594, 596 (CCPA 1980) (quoting In re Best, 562 F.2d 1252, 1255, 195 USPQ 430, 433-34 (CCPA 1977)).

MPEP 2112.01 [R-3] Composition, Product, and Apparatus Claims  
I. PRODUCT AND APPARATUS CLAIMS — WHEN THE STRUCTURE RECITED IN THE REFERENCE IS SUBSTANTIALLY IDENTICAL TO THAT OF THE CLAIMS, CLAIMED PROPERTIES OR FUNCTIONS ARE PRESUMED TO BE INHERENT  
Where the claimed and prior art products are identical or substantially identical in structure or composition, or are produced by identical or substantially identical processes, a prima facie case of either anticipation or obviousness has been established. In re Best, 562 F.2d 1252, 1255, 195 USPQ 430, 433 (CCPA 1977). "When the PTO shows a sound basis for believing that the products of the applicant and the prior art are the same, the applicant has the burden of showing that they are not." In re Spada, 911 F.2d 705, 709, 15 USPQ2d 1655, 1658 (Fed. Cir. 1990). Therefore, the prima facie case can be rebutted by evidence showing that the prior art products do not necessarily possess the characteristics of the claimed product.

MPEP 2113 [R-1] Product-by-Process Claims  
ONCE A PRODUCT APPEARING TO BE SUBSTANTIALLY IDENTICAL IS FOUND AND A 35 U.S.C. 102 /103 REJECTION MADE, THE BURDEN SHIFTS TO THE APPLICANT TO SHOW AN UNOBVIOUS DIFFERENCE  
"The Patent Office bears a lesser burden of proof in making out a case of prima facie obviousness for product-by-process claims because of their peculiar nature" than when a product is claimed in the conventional fashion. In re Fessmann, 489 F.2d 742, 744, 180 USPQ 324, 326 (CCPA 1974). Once the examiner provides a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art, although produced by a different process, the burden shifts to applicant to come forward with evidence establishing an unobvious difference between the claimed product and the prior art product.

MPEP 2114 [R-1] Apparatus and Article Claims — Functional Language  
For a discussion of case law which provides guidance in interpreting the functional portion of means-plus-function limitations see MPEP § 2181 - § 2186.  
APPARATUS CLAIMS MUST BE STRUCTUR-ALLY DISTINGUISHABLE FROM THE PRIOR ART

>While features of an apparatus may be recited either structurally or functionally, claims directed to an apparatus must be distinguished from the prior art in terms of structure rather than function. >In re Schreiber, 128 F.3d 1473, 1477-78, 44 USPQ2d 1429, 1431-32 (Fed. Cir. 1997) (The absence of a disclosure in a prior art reference relating to function did not defeat the Board's finding of anticipation of claimed apparatus because the limitations at issue were found to be inherent in the prior art reference); see also In re Swinehart, 439 F.2d 210, 212-13, 169 USPQ 226, 228-29 (CCPA 1971); < In re Danly, 263 F.2d 844, 847, 120 USPQ 528, 531 (CCPA 1959). "[A]pparatus claims cover what a device is, not what a device does." Hewlett-Packard Co. v. Bausch & Lomb Inc., 909 F.2d 1464, 1469, 15 USPQ2d 1525, 1528 (Fed. Cir. 1990) (emphasis in original).

The following is further clarified:

Re claim 19: inherently amorphous sub-layers.

In particular, the structure and composition of the invention of Li appears to have these inherent characteristics because the claimed structure and composition and the structure and composition of Li are at least substantially identical, and/or are produced by at least substantially identical processes; therefore, a prima facie case of anticipation has been established, and applicant is required to prove that the structure of LI does not necessarily or inherently possess the characteristics of the instant claimed structure.

Indeed, in the instant specification, page 5, lines 5-14 and page 9, lines 3-14, applicant discloses that these claimed characteristics are inherent characteristics of the claimed structure and composition:

Accordingly, a method is provided for the formation of very thin, multilayer diffusion barriers composed of even thinner sub-layers, where the sub-layers are only a few atoms thick. An aspect of this invention when forming these layers is to use the interfaces between each of the sub-layers to inhibit the formation of a crystalline lattice in each sub-layer. A strong bond between each of the sub-layers perturbs the regular crystalline structure of the sub-layer, as long as the sub-layer remains very thin. Since the surface energies dominate the bulk binding energies, the sub-layer remains disordered and in

a substantially amorphous state (i.e., essentially free of a regular crystalline structure). The lack of formation of a lattice within each sub-layer results in no grain boundary formation, and hence, no pathways for inter diffusion of metals through the barrier as long as the multilayer remains amorphous.

In FIG. 4, an atomic scale magnification of the layers of FIG.3 is shown. As seen in FIG. 4, the individual layers of FIG. 3 are preferably no more than 2-5 atomic layers thick. Because of the strong binding of the interface 470(a) . . . (n), generally 470, between each of the layers, there is no regular crystal structure in the 2-5 atom thick layer between interfaces 470. This region could be considered to be the 'bulk' of each of the layers. The nature of the surface binding energy is such that it dominates the normal tendency for the bulk atoms to form a conventional crystal lattice, in effect, inhibiting the formation of a lattice. Without a regular crystalline lattice, there are no breaks in the lattice that would constitute a grain boundary. Because there are no grain boundaries, the physical effect of work hardening is inhibited, resulting in a diffusion barrier with improved structural flexibility. Therefore, the material of FIG. 4 is a substantially amorphous, multilayer solid material and is highly resistant to the diffusion of a chemical species through the material.

Specifically, applicant discloses that sub-layers, such as the sub-layers of Li, which are "only a few atoms thick," and, "no more than 2-5 atomic layers thick, are inherently amorphous.

However, applicant does not appear to explicitly disclose the following:

Re claim 19: each sub-layer having a thickness of about 0.4 to about 4.5 nanometers (nm).

Re claim 82: each sub-layer has a thickness of about 0.4 to about 1.5 nanometers (nm).

Nonetheless, it would have been obvious to provide this/these claimed thickness dimensional limitation(s) because it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the

limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical.

See, for example, *In re Rose*, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); *In re Rinehart*, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); *In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966).

Furthermore, it would have been obvious to try this/these particular claimed dimension(s) because a change in dimension would have been a known option within the technical grasp of a person of ordinary skill in the art, and:

"[T]he court erred in concluding that a patent claim cannot be proved obvious merely by showing that the combination of elements was obvious to try. ... The same constricted analysis led the Court of Appeals to conclude, in error, that a patent claim cannot be proved obvious merely by showing that the combination of elements was 'obvious to try.' ... [A] person of ordinary skill in the art has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense. ... [T]he fact that a combination was obvious to try might show that it was obvious under §103." *KSR International Co. v. Teleflex Inc.*, 82 USPQ2d 1385 (U.S. 2007). See also, *Pfizer Inc. v. Apotex Inc.*, 82 USPQ2d 1852 (Fed. Cir. 2007); *In re Kubin*, 90 USPQ2d 1417 (Fed. Cir. 2009).

Also, as cited, Li discloses that sub-layer thickness is a result effective variable(s).

Therefore, it would have been obvious to try variations of this/these result effective variable(s), including the claimed variation(s) because:

"[T]he court erred in concluding that a patent claim cannot be proved obvious merely by showing that the combination of elements was obvious to try. ... The same constricted analysis led the Court of Appeals to conclude, in error, that a patent claim cannot be proved obvious merely by showing that the combination of elements was 'obvious to try.' ... [A] person of ordinary skill in the art has good reason to pursue the known options within his or her



technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense. ... [T]he fact that a combination was obvious to try might show that it was obvious under §103." KSR International Co. v. Teleflex Inc., 82 USPQ2d 1385 (U.S. 2007). See also, Pfizer Inc. v. Apotex Inc., 82 USPQ2d 1852 (Fed. Cir. 2007); In re Kubin, 90 USPQ2d 1417 (Fed. Cir. 2009); In re Aller, Lacey, and Hall, 105 USPQ 233 (C.C.P.A. 1955).

Moreover, as reasoned from well established legal precedent, it would have been an obvious matter of design choice bounded by well known manufacturing constraints and ascertainable by routine experimentation and optimization to choose the particular claimed thickness limitation(s) because applicant has not disclosed that, in view of the applied prior art, the limitation(s) is/are for a particular unobvious purpose, produce(s) an unexpected result, or is/are otherwise critical. For that matter, applicant has not disclosed that the particular limitation(s) is/are for **any** purpose or produce(s) **any** result. Indeed, it has been held that optimization of parameters and range limitations is prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical.

See MPEP 2144.05(II): "Generally, differences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. '[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.'"

Also see In re Aller, 220 F.2d 454, 105 USPQ 233, 235 (CCPA 1955); In re Hoeschele, 406 F.2d 1403, 160 USPQ 809 (CCPA 1969), Merck & Co. Inc. v. Biocraft Laboratories Inc., 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied, 493 U.S. 975 (1989), and In re Kulling, 897 F.2d 1147, 14 USPQ2d 1056 (Fed. Cir. 1990). As set forth in MPEP 2144.05(III), "Applicant can rebut a prima facie case of obviousness based on overlapping ranges by

showing the criticality of the claimed range. 'The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range.' In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990). See MPEP § 716.02 - § 716.02(g) for a discussion of criticality and unexpected results."

Applicant's remarks filed 6-04-09 have been fully considered and are adequately treated and/or rendered moot supra.

The art made of record and not applied to the rejection is considered pertinent to applicant's disclosure. It is cited primarily to show inventions relevant to the examination of the instant invention.

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

**For information on the status of this application applicant should check PAIR:**

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

**Alternatively, applicant may contact the File Information Unit at (703) 308-2733. Telephone status inquiries should not be directed to the examiner. See MPEP 1730VIC, MPEP 203.08 and MPEP 102.**

Any other telephone inquiry concerning this communication or earlier communications from the examiner should be directed to David E. Graybill at (571) 272-1930. Regular office hours: Monday through Friday, 8:30 a.m. to 6:00 p.m.

The fax phone number for group 2800 is (571) 273-8300.

/David E Graybill/  
Primary Examiner, Art Unit 2894